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Lewis Research Center

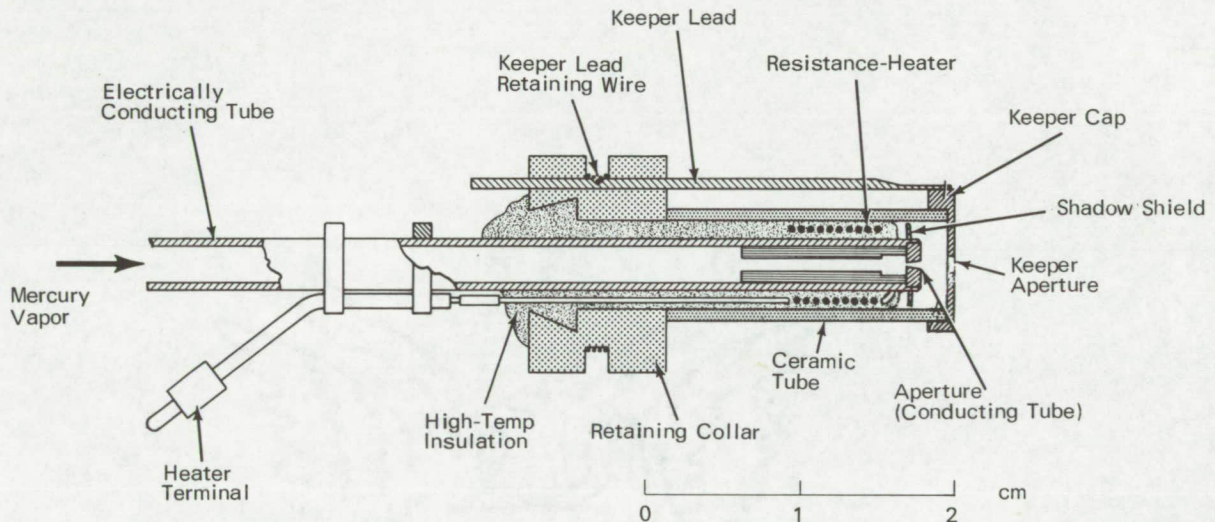


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Improved Electron Emitter

An improved hollow cathode or electron emitter developed for an electrostatic ion thruster may be applicable to other devices in which a plasma is generated by electron bombardment.

The emitter contains an electrically conducting tube for directing mercury vapor into an ion thruster. A resistance heater is secured to the tube end by a layer of high-temperature insulating material. The



The device is essentially a conventional hollow cathode modified by the addition of an integral keeper cap containing a small aperture which encloses the outlet of the cathode and is held in position by a ceramic (high-purity alumina) tube. The keeper cap, made of tantalum, is used instead of the concentric ring electrode of the conventional cathode. The new configuration protects the cathode from sputter-erosion by ions which may be attracted to the cathode from an external ionization chamber. In addition, the keeper enclosure provides a cavity for maintaining a secondary discharge zone at a plasma density most favorable for stable operation. The integral construction is more rugged and provides positive spacing and alignment of the keeper electrode.

ceramic tube surrounding the end of the conducting tube and the heater serves both as a radiation shield and as an insulated holder for the keeper cap.

During operation, a current is passed through the heater coil to heat the end of the electrically conducting tube, which functions as a hollow cathode. Mercury vapor flows through the tube to a small aperture aligned with the aperture in the keeper cap. A potential applied between the keeper cap and the heated tube (cathode) produces an electron emission which initiates an arc discharge. The plasma formed by this discharge reduces the negative space charge which builds up at the cathode surface, thereby enabling electrons to be discharged from the cathode through the aperture in the keeper cap and into the

(continued overleaf)

thruster ion chamber. A shadow shield protects the heater from sputtering damage as well as from the undesirable coating of sputtered material on the insulating surfaces.

Note:

No further documentation is available. Specific questions, however, may be directed to:

Technology Utilization Officer
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Reference: B71-10388

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to:

Patent Counsel
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